

What is claimed:

1. A nonvolatile memory cell comprising:

a semiconductor substrate;

a vertical MOS transistor formed by alternating N-type and P-type doped layers

in said substrate intersecting a well etched into said substrate, said well having a

floating gate of conductive material formed therein and insulated from and overlying said alternating N-type and P-type materials by a layer of gate insulating material;

a word line contact comprising a layer of conductive material formed on said substrate so as to extend down into said well and overlie said floating gate but insulated therefrom by an insulation layer; and

a bit line contact comprising a layer of conductive material formed on said substrate so as to be in electrical contact with the drain region of said vertical MOS transistor formed in said substrate.

2. A nonvolatile memory cell, comprising:

a semiconductor substrate of a first conductivity type having a surface;

a buried layer in said semiconductor substrate doped so as to have a second conductivity type suitable to act as a channel region of a vertical MOS transistor formed in said substrate;

a first region of said semiconductor substrate between said buried layer and said surface of said substrate, and a second region of said semiconductor substrate below said buried layer, both said first and second regions being doped so as to have a first conductivity type;

a first layer of insulating material covering said surface of said substrate;

a recessed gate window in the form of a well etched in said semiconductor substrate through said first layer of insulating material, said well being deep enough to penetrate said buried layer such that the side walls of said recessed gate window intersect said buried layer and said first and second regions of said semiconductor substrate;

a second insulating layer covering the bottom of said well;

a gate insulating layer formed on the sidewall of said well;

a floating gate comprising a conductive material formed on said gate insulating layer with an insulating layer formed over said conductive material so as to electrically isolate said floating gate from all surrounding structures, said floating gate having a

dimension suitable so as to overlie at least said intersection of said well with said buried layer;

a word line comprising conductive material deposited on said first insulating layer so as to extend into said well far enough to overlie at least a portion of said floating gate; and

a second layer of insulating material formed over said word line; and

a bit line formed over said surface of said semiconductor substrate but insulated from said word line by said second layer of insulating material, and deposited in a contact window formed in said first insulating layer so as to be in electrical contact with said first region, said first region acting as a drain of said vertical MOS transistor.

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a2  
Add  
C2  
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E2